

THE INFLUENCE OF EXTERNAL AND INTERNAL FACTORS ON THE DROP JUMP HEIGHT

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Abstract. *The Drop jump (DJ) is an important tool in muscle power development. There are different factors that determine DJ performance, of which the key external and internal are defined. The aim of this narrative review article is to present the factors that determine the performance of the DJ. The comparative analytical method is used to compare and comment on the results of available scientific studies. The results show that technique and instruction together, among external factors, highly determine DJ height. The highest determination of DJ height has age among its internal factors. These findings contribute to better management of motor abilities testing and the training process in order to accomplish high sports success.*

Key words: *Jump Height, Effects, Instruction, Age*

INTRODUCTION

Athlete training is a complex process from which coaches and athletes strive to achieve the best results. Towards that goal, coaches and athletes invest a lot of will, effort, knowledge, etc., qualities to devise and implement appropriate methods and tools (exercises) that provide adequate stimulus for further development of the athlete's abilities. Plyometrics is the most common and effective method for the development of explosive strength, whose main tool are jumps. According to Bubanj and associates (2010), explosive strength enables an athlete to perform a maximum acceleration of his body. Athletes use a drop jump (DJ) in sports training to develop their abilities, test their current abilities, and rehabilitate themselves. In training, the DJ is mainly used to develop strength and increase jump height (Bobbert, 1990; Marković, 2007; Marković & Mikulić 2010). Many different factors determine the performance of a DJ.

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The basic research problem in this article is complex and reads as follows: Which factors determine DJ height, which ones have the highest determination, and does integrated determination exist? The subject of this paper is the factors that determine the performance of the DJ. The basic method in the preparation of this article is a comparative analysis of the results of scientific and professional research. The goal of this paper is to interpret and clarify the factors that determine the DJ, to investigate which factors have the highest determination, and determine whether integrated determination exists.

Jumping and other natural forms of movement are an integral part of many sports and are based on plyometric muscle action. Plyometrics include a stretch-shortening cycle (SSC), consisting of an eccentric, isometric (amortization), and concentric phase. According to Schmidbleicher (1992), a fast SSC that lasts less than 250 ms and a slow SSC that lasts longer than 250 ms can be distinguished. The characteristic of plyometric exercises is that they are applied with minimal additional load or even without additional load (body weight only). When performing a DJ, different drop heights can be used to dose the intensity of this exercise. According to Zatsiorsky and Kraemer (2006), if the jump is performed from a moderate drop height, this will allow the muscles to generate sufficient force to create an eccentric contraction that activates the muscle spindle (a stretch reflex) that will intensify the subsequent, concentric contraction. Otherwise, if a DJ is performed from an exaggerated drop height, rapid tendon stretching can occur, which Golgi's tendon organ registers and inhibits muscle activation, thereby instantly switching off the concentric contraction. Depending on the duration of the plyometric training program, Stojanović, Ristić, McMaster, & Milanović (2017) found that 12 weeks resulted in a significant improvement in DJ height compared to the 6-week program duration for athletes of different training experience. Veličković, Bojić, & Berić (2017) also confirmed these findings in their study, where a 12-week plyometric training program leads to an improvement in DJ height by 4.83 cm in volleyball players between the ages of 14 and 16.

Factors can be observed as independent variables, which mean that they do not depend on other variables. That being said, they can determine the magnitude and quality of other, dependent variables. A single determination of factors can be called mono-causality, and integrated determination can be called multi-causality. The intensity of the determination of the factor can have different levels, ranging from small, moderate, large to strict determinism (e.g., genes as carriers of hereditary traits). Furthermore, they can determine the independent variable in a negative or positive direction. In integrated determination, a single factor may exhibit a different intensity of determination on the same dependent variable, in accordance with more determining factors, such as poor road conditions combined with the presence of fog, rain, snow, ice, etc.

The division of factors into external and internal was established by Matić (2016a) and further elaborated for the purpose of this article. That distribution is made toward impersonal (ambiance) and personal (individual) attributes. Jump height, external load, and jump technique as external factors, and training level, sex, and age as internal factors are considered.

The aim of this narrative review article is to present the factors that determine the performance of the DJ.

METHODS

In this article a comparative analytical method is used to compare and comment results of relevant scientific articles. By searching PubMed and Google search engines, the relevant articles to the topic of this paper were selected and processed.

RESULTS AND DISCUSSION

External factors that determine DJ performance*Drop height*

In studies and sports training, different drop heights are used to improve jump height and other effects of this exercise. There are several studies that have investigated the drop height. Viitasalo and Bosco (1982) in their study investigated the drop height of 20, 40, 60, 80, and 100 cm on the DJ height among students. No statistically significant differences among the students were found in the achieved jump height between the given drop heights. In a subsequent study, Viitasalo, Salo, & Lahtinen (1998) examined the effects of 40 cm and 80 cm drop heights in physically active students and triple jumpers of a national rank. At both drop heights, the triple jumpers achieved the same jump height of 47 cm, while the students performed a jump of 35 cm for both drop heights. Thus, these two cited studies did not find that there was an influence of the drop height factor on jump height. However, Young, Pryor, & Wilson (1995) indicated different, positive findings. Low determination of this factor exists at a 30, 45, and 60 cm drop height, with the highest jump heights achieved at a 30 cm drop height - the smallest height. This is represented in Table 1.

Table 1 Jump height, contact time and jump height/contact time for all conditions-instructions (Young et al., 1995)

Drop Height (cm)	Jump Height (cm)	
	M	SD
Drop Jump for Height (DJ-H)		
30	40.2	7.7
45	39.8	7.9
60	39.6	7.8
Drop Jump for Contact Time (DJ-t)		
30	12.5	6.5
45	10.3	6.1
60	9.3	6.2
Drop Jump for Height/Contact Time (DJ-H/t)		
30	33.1	5.0
45	32.3	5.6
60	31.3	5.8

Legend: M-The Arithmetic Mean; SD-Standard Deviation.

In Matic (2015), the aim was to determine the methodological aspects of intensity optimization for the DJ. His research included a group of strong students and a group of weak students, based on 1RM test in the half squat. Then, all the students performed a DJ from 12 to 82 cm drop heights. The results show that at drop heights of 42, 50, 62 cm, the

highest jump heights are expressed relative to the smaller or larger drop heights. Stronger participants achieved higher jump heights at higher drop heights than at low drop heights, while the weaker did the opposite. Also, differences in the studied variables were found, such as reaction force of the ground, maximum muscular power, average muscular power, ground contact time, etc., where the group of strong participants expressed better values in relation to the weak group. This indicates that there is a need to determine the best drop height individually for every athlete in order to improve the efficiency of training procedures that will lead to greater jump height. Matic (2015) concludes that a good way to dose the intensity of a DJ is to use the drop height when the intensity is defined by the variables examined. Based on more recent findings by Matic (2018) optimal DJ height (DH_{opt}) should be regulated in accordance with maximal muscle strength which is assessed in multi-joint locomotion.

Based on the aforementioned studies, it can be inferred that drop height (acutely) has a low determination of DJ height improvement. In addition, this factor exerts an influence on jump height also through delayed training effects, as evidenced in a study by Gehri, Ricard, Kleiner, & Kirkendall (1998) in which an improvement of 2.79 cm resulted after 12 weeks of DJ training, and in a study by Young, Wilson, & Byrne (1999) where after six weeks of application of this exercise with instructions (DJ-H) and (DJ-H/t), an improvement of 1.9 cm and 1.3 cm occurred. By comparing Gehri and associates (1998) and Young and associates (1999), it can be inferred that a higher delayed effect is achieved with longer training regime duration. Also, in the second study, instruction (DJ-H) led to a larger delayed effect over the same time period, which was specifically explained in the instruction factor. Thus, the drop height factor has low determination of DJ height, whether acting alone or combined with other factors such as instruction, training level, external load, etc.

External load

The applied external load can take the form of free weights, load vests, elastic bands, etc. In their research, scientists have assumed that elastic bands can prompt a SSC, which would contribute to an increase in jump height. Accordingly, two studies are presented explaining the impact of elastic bands on DJ height.

In the first study by Makaruk and associates (2014), the aim was to investigate the influence of supported and standard DJ on exercises involving a rapid SSC. Students who competed in different sports were randomly divided into three groups: a group that performed the assisted DJ; a group that performed the standard DJ; a control group, which did not engage. The assisted jump was performed with a gray, strong elastic band, which was attached to the ceiling, and waistband worn by the examinees. The band was stretched at a distance of 3.5 m and aided 10% of the participant's body mass in the concentric jump phase, but also reduced the load in the eccentric jump phase. All three groups were involved in a 5-week training program using 30 cm and 60 cm drop heights. Prior to the start of the program, a strength test of 1RM was performed in the squat exercise for all three groups, where the group performing the standard DJ and lifted the heaviest weight. Also, all three groups performed a jump from a 30 cm drop height, and the following jump heights were obtained: 37.9 cm for the first group; 39.1 cm for the second group; 37.5 cm for the third group. After five weeks of the training program, the tests were performed again at the same drop height and the following jump heights were obtained: 41.1 cm for the first group; 42.6 cm for the second group; 37.8 cm for the third group. The first two groups enhanced the jump height noticeably compared to the heights before the training program and higher

jump heights compared to the control group. The highest jump height was achieved in the second group.

Testing the groups before the start of the training program at a 60 cm drop height gave the following jump height: 39.6 cm for the first group; 41 cm for the second group; 38.4 cm for the third group. After five weeks of the training program, the tests were performed again at the same drop height and the following jump heights were obtained: 43 cm for the first group; 43.5 cm for the second group; 38.2 cm for the third group. As with the 30 cm drop height, there is a significant improvement in height of the jump compared to the achieved heights before the start of the program and the higher height of the jump in regard to the control group. The highest jump height was achieved in the second group.

Observing the results of the study, both experimental groups tested at 30 cm and 60 cm drop heights significantly improved their jump height compared to the achieved heights prior to the training activity and in regard to the control group.

According to researchers, DJ with elastic load and DJ without load equally influence the height increase over a given period of time. In addition, higher values of the reactive coefficient were found and a significantly lower ground reaction force during the jump with applied elastic loading. Also, elastic bands have contributed to the reduction of impact forces at ground contact, which reduces the risk of injury. It is concluded that the use of elastic bands has significant additional effects, so it can be used to improve jump height in sports such as basketball, volleyball, athletics, etc.

In another study by Aboodarda and associates (2014), the goal was to investigate the impact of elastic bands in the DJ eccentric part in one session. All of the athletes participating in the study were able to lift weight in the squat twice as much as their body mass. They made the DJ in three ways: no additional load; 20% load of body mass from elastic bands; 30% load of body mass from elastic bands. Gray, black, blue, red, yellow colors of elastic bands were used in combination to achieve the desired load. The jump was performed with the assistants standing with their feet fixed on one end of the elastic bands, while the other end of the bands was attached to the examinee. Elastic bands provided an eccentric load during the drop phase, and then assistants released one end of the band during the amortization phase to perform the concentric phase without additional loading. DJ was performed with a drop height of 20, 35, and 50 cm. Test results show that each group achieved almost identical jump heights at all jump heights, ranging from 39 cm to 41 cm. When DJ was performed with an elastic load at a drop height of 35 cm, greater jump heights of 1 cm were achieved than for the DJ without a load. This indicates that the elastic load in the form of elastic bands has a small influence on the acute increase in DJ at the determined drop height. Also, the application of this load increases the tolerance of athletes to a large eccentric load during the amortization phase, which may have significance in reducing injuries. This can be especially useful for sports with a high eccentric load, such as athletics, gymnastics, and alpine skiing.

Analyzing the described studies, the external load in the form of elastic bands can act acutely and in a delayed fashion. With acute action, it has a small influence on increasing the height of the DJ, while delayed action for 5 weeks affects the similar increase in the height of the DJ and the jump without any additional load. In the first study, this factor acts contingently with the drop height factor, and a higher jump height is obtained at a 30 cm drop height than at a 60 cm drop height. In the second study, a contingent effect manifested at a 35 cm jump height. It can be concluded that elastic bands have a small effect of increasing the height of the DJ and have additional described effects, and their use in previously mentioned sports is recommended. For more practical jump performance, it is recommended to wear belts that allow the elastic bands to be released quickly.

Jump technique

A DJ is a jump that is performed from a standing position from a platform of a certain height by moving one-foot forward – the initial position (a), then dropping on both feet simultaneously – the amortization phase (b) and performing a maximal jump (c).

When performing a DJ, it is not recommended to jump out from the box, because it can lead to a longer amortization phase and produce high impact forces on the ground. Depending on the goal, a variety of DJ techniques can be applied, such as: performing a jump on two legs, on one leg, with a longer or shorter amortization phase, as explained in a subsequent study.

Depending on the duration of the amortization phase, Bobbert and Huijing (1987) divided the jumps into two groups:

- The Amortization drop jump (ADJ) characterized by larger downward movement and longer amortization phase. It corresponds to a long SSC;
- The Reactive drop jump (RDJ) characterized by smaller downward movement and shorter amortization phase. It corresponds to a short SSC.

Based on the results of a study by Bobbert and Huijing (1987), in which participants performed a DJ of 20, 40, and 60 cm, it was found that the body's center of gravity is higher when performing a DJ of 20 and 40 cm, compared to a drop from 60 cm. The first performance corresponds to the RDJ technique, while the second corresponds to the ADJ technique. The use of the ADJ technique resulted in a higher jump than the RDJ technique. The authors do not see the purpose of making RDJ from a 60 cm drop height, so they recommend using a 20 to 40 cm drop height for this technique.

Basketball is a sport that requires the exertion of explosive movements in order to achieve maximum jump height or to perform rapid changes of direction, acceleration, stopping, etc. In a study by Struzik, Juras, Pietraszewski, & Rokita (2016), differences between ADJ and RDJ techniques were studied in a group of young basketball players at 15, 30, 45, and 60 cm drop heights. When performing both jumps, hands were held on the hips. At given drop heights, fairly consistent jump height values were obtained for the ADJ technique from 0.33 cm to 0.35 cm; and there are also consistent jump heights from 0.28 to 0.30 cm for the RDJ technique. It can be concluded that at the same drop heights, participants with the ADJ technique achieve higher jump heights than with the RDJ technique. Therefore, depending on the given situation or the purpose of the training, the technique of the DJ should be adapted to produce the desired adaptations in basketball or another sport.

Analyzing the described studies, the jump technique highly determines the magnitude of DJ height. Also, in the case of integrated action with the drop height, the determination of the DJ is increased.

Instruction

When performing some movement or locomotion, the verbal instructions given by the coaches and researchers to the athletes can significantly affect the quality of the performance. There are verbal instructions with an external focus that direct the attention of the person to the environment, and instructions with an internal focus that direct attention to the movements and locomotion of the person. External focus instruction has been shown to have a far greater effect than internal focus instruction.

In a study by Young and associates (1995), which aimed to compare the act of separate instructions on DJ and countermovement jump (CMJ) performance, 17 students with experience in sports and jumping participated. The participants performed a DJ from 30, 45, and 60 cm, where three conditions (instructions) were made:

- Perform a DJ in order to achieve maximal jump height (DJ-H); participants strive to achieve maximum jump height,
- Perform a DJ in order to achieve maximal jump height and immediate contact with the floor (DJ-H/t); participants strive to achieve a maximum height of the jump, and reduce the time of contact with the floor,
- Perform a DJ in order to achieve a short contact time (DJ-t); participants strive to achieve minimum ground contact time.

Analyzing the results of the study, it can be concluded that the greatest DJ heights are achieved with (DJ-H) instruction compared to other instructions; the (DJ-H) instruction corresponds to the ADJ jump execution technique. Therefore, in improving the jumps and making specific adaptations in the training process, instructions should be used to make the athletes perform jumps similar to those performed in competitive conditions. That is, if the sport requires explosive strength, it is recommended to use a (DJ-H) instruction, which will allow a maximum jump height. However, in the case of a sport requiring the use of reactive power, (DJ-H/t) instruction is recommended, which will allow the power to be displayed in the shortest possible time.

In a more recent study by Oliver, Barillas, Lloyd, Moore, & Pedley (2019) which examined the effect of verbal instruction with an external focus on young football players on performing DJ from 30 cm drop height, there were four different performance conditions:

- Control conditions (CONT): “With your hands on your hips, step off with one leg, drop on both feet, and perform a maximal jump”;
- Contact instruction (CI): “Make contact with the ground as short as possible”;
- Height instruction (HI): “Get as close to the ceiling as possible”;
- Quiet Performance instruction (QPI): “During the performance, try to make the quiet drop, then perform a maximal jump.”

Analyzing the study results, all the instructions produced a specific immediate response. On average, the (HC) instruction determined a higher jump height in regard to other instructions, which can be seen in Table 2.

Table 2 Average drop jump heights for all performance conditions

Performance measures	CONT	CI	HI	QPI
Jump height (cm)	23.5	21.4	26.0	21.9

Legend: CONT-Control Conditions; CI-Contact Instruction; HI-Height Instruction; QPI-Quiet Performance Instruction.

In order to develop the reactive power of young athletes, a CI should be introduced gradually to minimize the risk of injury. The findings of the study by Oliver and associates (2019) are in line with previously conducted studies that examined instructions with an external focus in adults and found that performing a DJ depends on the conditions of the instruction given (McNair, Prapavessis, & Callender, 2000; Prapavessis, McNair, Anderson, & Hohepa, 2003; Khuu, Musalem, & Beach, 2015).

Comparing the studies, an integrated act of the instruction (DJ-H) and technique in the first study has a high determination on the expression of a higher jump height than the other

instructions. In the second study HI: “Get as close to the ceiling as possible” had a small influence on achieving greater jump height. Depending on the goal of performing the movement and locomotion, whether it is a research or training process, coaches and other professionals should use appropriate instruction to increase DJ height and improve the quality of the performance.

Internal factors that determine DJ performance

Training level

Training level implies varying degrees of motor abilities, which one possesses. Muscle force (strength) is one of the key motor abilities, which according to Kukulj (2006) represent the ability of a muscle to act with great forces under static conditions or against high resistance at low speeds of muscle contraction. A study by Matić (2015) found that weaker participants achieved greater DJ height after smaller drop heights (22-32 cm) than from higher drop heights (62, 72, 82 cm), while stronger participants increased DJ height from a higher drop height. This indicates that stronger participants need a greater external load (drop height) in order to exert maximum muscle power during the concentric jump phase and thus achieve greater jump heights. Since this is a higher external load (drop height), it is, therefore, necessary to exert greater muscle force. It can be concluded that the level of training determines which level of the drop height will be applied in the testing or training process.

Beattie and associates (2017) examined the connection between maximal muscle strength and reactive power. Athletes, based on the measured maximal isometric force (strength) in the mid-thigh pull, are divided into a strong and weak group. Then, all the participants performed a DJ from 30, 40, 50, 60 cm. Analyzing the study results, weaker athletes achieved lower jump heights at higher drop heights, while stronger athletes showed the same values at all drop heights. Also, the results show that stronger athletes achieved significantly higher jump heights at all drop heights compared to weaker participants. This indicates the importance of training for the development of muscle strength, which contributes to greater DJ height.

It can be concluded that the training level factor, specifically muscle strength in the first study, acts in combination with the drop height, which determining a higher DJ height. In another study, the combined influence of these factors can only be observed in weaker participants, which is not the case in stronger participants.

Sex

Sex refers to the biological characteristics of men and women. There are some obvious physical differences between men and women. Also, men and women differentiate in upper body size and strength, which can determine and limit success in sports movements, like spike velocity in volleyball or shooting range in basketball (Zatsiorsky, Kreamer, Fry, 2020). This and other differences need to be considered when training athletes.

Laffaye and Choukou (2010) examined the difference in DJ height between nine top male volleyball players and nine top female volleyball players at 30 and 60 cm drop height. From the results, men achieved, on average, higher jump heights of 46.6 cm for the DJ30 and 46.5 cm for the DJ60 than women who achieved 36.3 cm for the DJ30 and 35.7 cm for the DJ60. This can be represented by an average difference of 46.6 cm for men and 36 cm for women, or 22.7% difference between the sexes. Also, it has been observed that the

technique at the DJ60 in both sexes changes with respect to the DJ30, indicating that this height is not adequate. This means that it is needful to find the appropriate drop height for both sexes. Also, coaches should approach with appropriate instruction for both sexes and correct poor jump technique.

In several sports disciplines, unsteady activities such as jumping on rough terrain in football or jumping on a mat in gymnastics occur. In order to meet the specific requirements of sports discipline, Pilates balls, BOSU balls, and balance discs are often used in training. In a study by Prieske and associates (2014), the difference between physically active men and women when performing a DJ from a drop height of 40 cm on a stable and unstable surface was examined. Higher jump heights were found that were performed under stable conditions compared to unstable conditions. Jump height was significantly lower for jumping on unstable ground, and no sex differences were found in jump height.

Analyzing the described studies, it can be noticed that higher jump heights in the first study were accomplished with an integrated determination of training level factor and sex factor, whereas the introduction of unstable substrate factors, as described in the second study, led to a lower result.

Age

Age and maturation highly determine the expression of motor abilities. There is a big difference in DJ heights achieved between children and adults. Lazaridis and associates (2010) investigated the difference between 12 untrained pre-pubertal boys and untrained men in a DJ of 20 cm drop height. The results of the study show that men performed a 33 cm jump height on average, while boys achieved 15 cm. In addition, less electromyographic muscle activity and activation of the stretch reflex were measured in boys compared to men; the worse performance of the boys' technique by more flexion in the hips during the amortization phase, indicating a less efficient use of SSC. Therefore, it was concluded that the height of the DJ is age-dependent.

Snyder and associates (2018) investigated the difference between a group of young basketball players aged 16 and a group of adult men (strength-trained) at the age of 23 in performing a DJ from 40 cm drop height. The results show that men achieved a 36 cm jump height on average, in regard to adolescents, who achieved 30 cm. The instruction was to make the highest and fastest jump.

It can be concluded that in the second study, higher jump heights were achieved by a greater influence of age and training level factors by the integrated act. Regarding the difference of jump heights between the groups, it is observed that in the first study there are twice bigger differences, which is exclusively achieved by the difference in years since both groups are untrained. In the second study, the difference between the groups is much smaller, which can be attributed to the specificity of basketball training that involves plyometric and strength exercises, as well as older age. On the basis of the above, it can be concluded that in the first study the greatest influence on DJ height is realized by the age factor, while in the second study there is an integrated effect of the age and training level factors.

According to Bompa and Buzzichelli (2015), at the age of 11-14 (early adolescence), training for children may contain low-intensity plyometric exercises, which should be applied as a game, while more demanding plyometric exercises should be included when children reach the age of 15 to 18 years (middle adolescence). A condition for good performance of jumps in children and young people is correct technique and sufficient development of muscular strength.

CONCLUSION

In this article, it was determined that all the considered factors determine DJ height. The highest determination in the case of external factors have technique and instruction factors by their combined effect, depending on the type of instruction given, the athlete/participant adapts the technique of the DJ. In this way, shorter or longer contact with the ground is achieved, as well as greater or lesser amplitude in the joints of the hip, knee, feet during the amortization phase of the jump, and that way it contributes to a higher DJ height. The highest determination among internal factors were found for the age factor, where children and adolescents, despite their training level factor, achieve significantly lower jump heights than adult participants. However, if the training factor is considered, whose greater impact can be expected at the age of middle or late adolescence (higher training loads and more specific training) than early adolescence, the difference in jump heights compared to adults will be smaller.

It is important to mention that in addition to the intensity of the influence of factors, there are other important effects of certain factors. Namely, drop height is the main factor that defines the intensity of DJ load, indicating the individual differences of athletes/participants and the need to determine the optimal height for each individual in order to make adequate progress in motor abilities and jump height. Then, elastic bands are a factor that can determine the tolerance threshold of large eccentric loads, thereby producing a specific effect essential for sports such as athletics, gymnastics, alpine skiing, and others. In addition, they also contribute to reducing the impact force of the jump during the amortization phase, and minimizing the risk of injury. Next, the level of training, that is, the muscle force (strength) in the 1RM test and in the isometric test shows a reliable relationship with DJ height, indicating the importance of this motor ability and the application of the aforementioned tests. Then, sex is a factor that indicates the specificity of the sexes and also higher DJ heights achieved in highly trained male volleyball players compared to female volleyball players. There were no differences between the sexes in the recreationally trained participants, but with the introduction of an unstable surface, jump height was significantly smaller for both sexes compared to stable conditions.

Coaches and other sports professionals from athletics, basketball, volleyball, football, handball, and others, should have a holistic knowledge of the determination and other important effects of external and internal factors affecting DJ height in order to manage the training process more effectively and efficiently. Also, it is necessary to further deepen the knowledge of the determination of external and internal factors, as well as other effects of the DJ, using scientific methods and instruments. To more accurately measure the level of determination of these and other factors, it is necessary to prepare an impact scale in advance with defined criteria and values for distribution by levels on a given scale.

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UTICAJ SPOLJAŠNJIH I UNUTRAŠNJIH ČINILACA NA VISINU SKOKA IZ SASKOKA

Skok iz saskoka (prema engl. Drop Jump, DJ), je važno sredstvo u razvoju snage mišića. Postoje različiti faktori koji određuju DJ, sa definisanim ključnim spoljašnjim i unutrašnjim faktorima. Cilj ovog narativnog preglednog rada je da se predstave faktori koji karakterišu tehniku izvođenja skoka iz saskoka. U radu je korišćena komparativna analitička metoda, kojom su upoređivani i diskutovani rezultati dostupnih naučnih istraživanja. Rezultati istraživanja su pokazali da tehnika i instrukcija zajedno u najvećoj meri određuju visinu DJ kod spoljašnjih faktora. Kod unutrašnjih faktora uzrast najviše određuje visinu DJ. Dobijeni rezultati doprinose kvalitetnijem upravljanju testiranja sposobnosti i trenažnog procesa sa ciljem ostvarivanja visokog sportskog uspeha.

Ključne reči: visina skoka, efekti, instrukcija, godine života